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LETTUCE MOSAIC VIRUS

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Lettuce mosaic virus (LMV) was first reported in 1921 in Florida by Jagger (6). Due to transmission of LMV through seed, it has now been reported in at least 14 countries (4) or wherever lettuce is commercially grown. Although specific leaf symptoms are difficult to detect in mature lettuce, the overall effect on lettuce production is significant in terms of stunting, the absence of heading, and early bolting. The 50-million dollar per year Florida lettuce industry was severely threatened during the early 1970's by an outbreak of LMV. Fortunately, the lettuce growers in California had already established a viable indexing program for control of LMV through years of observation, experimentation, and research. This program was designed to establish the minimum allowable percentage of infected seed in commercial seedlots. It had been demonstrated that even with 1-3% infected seed, the spread by aphids could lead to 100% infection by harvest time. Research has shown that seed infection greater than even 0.1% gives inadequate disease control (2). Therefore, the allowable tolerance under Florida law adopted in 1973 and by California at an earlier date is less than one infected seed in 30,000. If one seed in 30,000 is infected, the entire seedlot is rejected.

SYMPTOMS: Symptoms of LMV are most easily detected in young plants. First seen is an inward rolling of the leaves along the long axis, and the first true leaf is irregularly shaped and slightly lobed. A mottling or mosaic pattern then develops (Fig. IA), often with vein clearing and bronzing (3). As plants mature, these symptoms are absent and other symptoms must be relied upon for detection. In the field, this can be seen as severe stunting, yellow coloration, failure to head normally, and downward curling of outer leaves (Fig 1B). Also, infected plants tend to bolt earlier than normal (3).

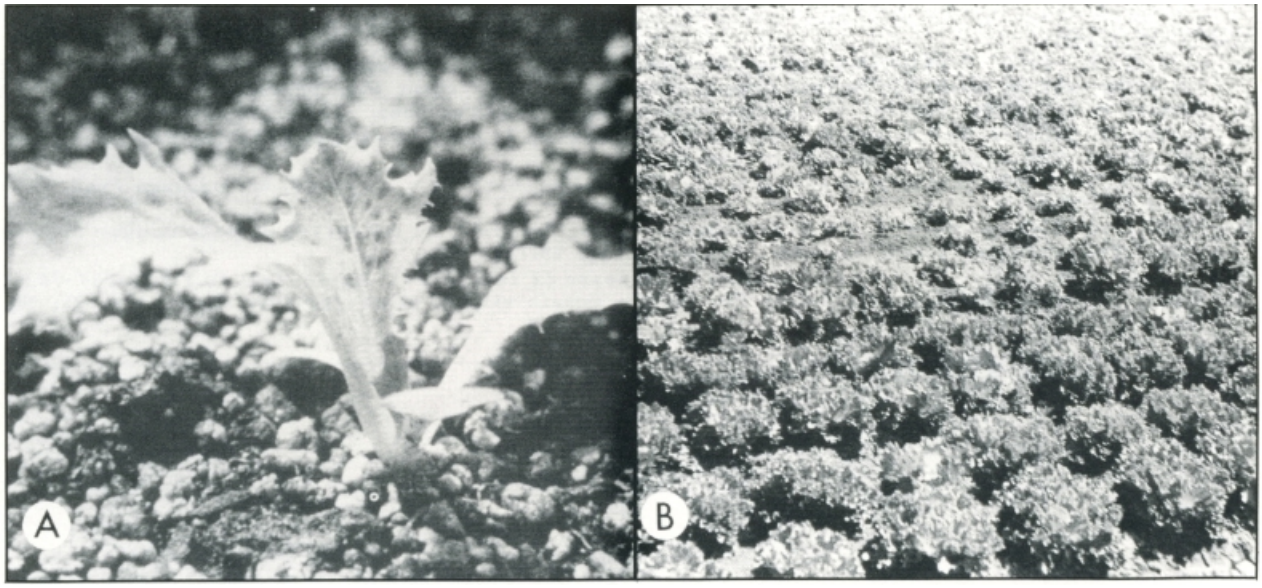

Fig. 1. Lettuce mosaic virus. A) Seedborne LMV-infected lettuce seedling with mottling symptoms. B) LMV-infection center in a commercial lettuce field. Affected plants are stunted and yellowed. (Photos courtesy of R. G. Grogan.)

CAUSAL AGENT: LMV is a member of the potyvirus group. It is both seed and aphid-transmitted. LMV has a wide host range, including 20 plant genera in 10 families. The infected seed is the most important element in disease development.

DISEASE DEVELOPMENT: Although infected seed is the main source of primary inoculum, aphids contribute significantly to LMV spread in the field. In spite of the wide host range of LMV, alternate weed hosts have not been proven to be important in the etiology of this disease. If the primary inoculum from seed is eliminated, even with aphids present, there will be little problem with LMV in commercial production.

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CONTROL: The early work in California with virus free seedlots quickly convinced the growers of the benefits of a seed indexing program for LMV (2). In 1961, the first method to be used for detecting infected seedlots was the seedling grow-out test where large numbers of seedlings were raised in a greenhouse and observed for symptoms. Those with no infected seed in 30,000 were used for commercial production. This system was extremely expensive and time consuming, however, so it was replaced by a plant indicator test using Chenopodium quinoa Willd. The C. quinoa test was used in Florida from 1974 until 1983. This test has several drawbacks because it is time-consuming and requires insect-free air conditioned greenhouses (1). Recently, a sensitive serological technique has been developed using ELISA (acronym for enzyme-linked immunosorbent assay). Because of the sensitivity, small space and time requirements, and the ease with which large numbers of samples can be processed, ELISA has proven to be a successful alternative to the previous indexing systems (1,5). Experimentation has proved ELISA to be as sensitive in detecting LMV in seed as the C. quinoa test, and testing can be done all year, whereas C. quinoa testing was limited to the cooler months.

The Lettuce Mosaic Committee in Florida decided in 1984 to adopt the ELISA system, developed and modified by Dr. B. W. Falk, as the seed indexing technique (7). A commercial seedlot containing at least 30,000 seeds is sampled and sent to the Division of Plant Industry in Gainesville where ELISA indexing is performed. In all cases, both healthy and infected seedlots are included as controls. Sixty subsamples containing 500 seeds each are tested and if one seed is infected, the whole seedlot is rejected. It is believed that the ELISA indexing system, in conjunction with avoidance of old lettuce beds in close proximity will successfully control LMV.

SURVEY AND DETECTION: Symptoms in mature lettuce are very difficult to detect other than a general stunting, yellowing, failure to head, and early bolting. Distinctive symptoms are most easily seen in very young seedlings in the form of mosaic, mottling, and bronzing of the leaves. The overall field symptoms usually appear in patches originating at the source of inoculum (seed) and the aphid spread from that point.

LITERATURE CITED.

1. Falk, B. W. 1983. Development and application of an enzyme-linked immunosorbent assay (ELISA) test to index lettuce seeds for lettuce mosaic virus in Florida. Plant Dis. 67:413-416.
2. Grogan, R. G. 1980. Control of lettuce mosaic with virus-free seed. Plant Dis. 64:446-449.
3. Grogan, R. G., J. E. Welch, and R. Bardin. 1952. Common lettuce mosaic and its control by the use of mosaic free seed. Phytopathology 42:573-578.
4. Horvath, J. 1980. Viruses of lettuce. I. Natural occurrence - a review. Acta Agron. Acad. Sci. Hung. 29:62-67.
5. Jafarpour, B., R. J. Sheperd, and R. G. Grogan. 1979. Serological detection of bean common mosaic and lettuce mosaic viruses in seed. Phytopathology 69:1125-1129.
6. Jagger, I. C. 1921. A transmissible mosaic disease of lettuce. J. Agric. Res. (U.S.) 20:737-741.
7. Perry, L. 1983. ELISA spells defeat for lettuce mosaic virus. Plant Industry News. Vol. 25, No. 2, 6-7.

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